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Cable drum for a video endoscope

State of the art

The invention originates from a cable drum for a video endoscope according to the kind of the main claim.

From the DE-OS 197 48 795 such a cable drum for a video endoscope designed as probe is well known, in whose top besides a video sensor one or several light-emitting diodes (LED) or bulbs for the lighting of the surrounding to be recorded by the video camera are arranged. However, the strength of the light radiated from such lamps is too small for many applications. The frequency spectrum of this light is limited as well, so that the light does not show the properties of daylight quality and usually has a bluish or yellowish color. In the long run the space required by the light emitting diodes or the bulbs leads to a relatively large overall diameter of the probe top, so that thereby the spectrum of the application possibilities of the well-known endoscope is severely limited.

The invention and its advantages

The cable drum according to the invention for a video endoscope designed as probe with the characteristic features of the main claim, has in contrast to this the advantage to provide light with daylight quality and larger strength by means of built in lamps. This light is conducted through optical cables to the top of the endoscope during the winding up and winding off of the probe.

After a favorable embodiment of the invention a circular cover plate is firmly connected with the stand, which covers a central and open towards the front hollow space of the cable drum, which accordingly is in particular suitable for the accommodation of such accessories for the endoscope, which are to be fastened to the stand or to the cover plate, because too many rotation movements can impair the operability of the concerning accessories.

After a further favorable embodiment of the invention plug sockets which are electrically interconnected with the slip ring at the cover plate are arranged for the output of the signals supplied by the video camera, to which different output devices for video signals can be attached through plugs in a simple manner.

After a further favorable embodiment of the invention a re-chargeable battery is arranged in the hollow space, which is mechanically attached to the stand and electrically connected to the slip ring, whereby at the cover plate a plug socket for DC voltage, electrically connected with the battery, is attached. Additionally the battery can be attached to the stand outside of the hollow space. Thereby a network-independent

operation of the endoscope including cable drum is possible.

After a further favorable embodiment of the invention a power supply connected mechanically with the stand is arranged in the hollow space, which is electrically attached to the slip ring, whereby at the cover plate a plug socket for AC voltage, connected with the power supply, is arranged. The power supply can be attached to the stand outside of the hollow space here as well. Thereby a long-term power supply, especially of the lamps arranged in the cable drum, which have relatively large energy consumption because of their high light power, is ensured in a compact way.

After a further favorable embodiment of the invention the centrally located hollow space of the cable drum is surrounded by a ring-shaped hollow space, which is accordingly pivoted arranged, in which the lamps are arranged and into that the beginning of at least one optical cable is inserted. Here the ring-shaped hollow space is especially suitable for the accessories of the endoscope, which is located in direct connection to the optical cable so that only a short piece of it has to be inserted into the inside of the cable drum, in order to be connected with the accessories concerned.

After a further favorable embodiment of the invention a circuit is arranged for the control of the video sensor in the ring-shaped hollow space, which thereby can be connected directly with the video sensor without inserting a slip ring, so that the development of error signals and a resulting misguided control of the video sensor are avoided to a large extent.

After a further favorable embodiment of the invention a fan for cooling the lamps supplied with current by the power supply is arranged at the wall of the ring-shaped hollow space near the lamps. This makes the use of particularly bright lamps possible, which are characterized by a large energy consumption and therefore large heat development.

After a further favorable embodiment of the invention the lamps are designed as arc lamps, as xenon lamps or as metal halide lamps; these lamps are characterized by a large luminous efficiency and a pronounced daylight quality.

Further advantages and favorable embodiments of the invention are can be taken from the following description of the example, the drawings and the claims.

Drawings:

Following a design example of the invention is represented and described in more detail in the drawings. Shown are:

Fig. 1 a partially cut side view of a cable drum for a video endoscope in accordance with the invention,
Fig. 2 a sectional view of the cable drum along the line A-A in Fig. 1 and
Fig. 3 a schematic representation of the photometric elements of the cable drum.

Description of the design example:

In Fig. 1 a cable drum 1 for a video endoscope 3 designed as probe 2 is shown in side view. It is especially used in the industry for the investigation of unlighted cavities and ducts. The cable drum 1 is held by a stand 4 with two feet 5 and 6 and a hand grip 7, which has in the chosen layout the form of a star with three rays 4, 5, and 6, in whose center 8 a horizontal axle 9, which is described below in more detail, is arranged on which the cable drum 1 far situated, is pivoted arranged.

In accordance with Fig. 1 and 2 a circular cover plate 10 is firmly connected with the stand 4; the cover plate 10 covers toward the front a central hollow space 11 of the cable drum 1, which is located behind it; in which necessary accessories for the operation of the endoscope 3 can be located, as for example a re-chargeable battery 12 and a power supply 13. Further arranged at the immovable cover plate 10 are plug sockets 14 and 15 for the output of the signals which are supplied by a video sensor 16 for color recordings which is arranged at the end of the probe 2, a further plug socket for DC voltage 17, and a plug socket for AC 18, in order to supply the power supply 13 with voltage.

The central located hollow space 11 of the cable drum 1 is surrounded by a further ring-shaped hollow space 19, in which further accessories 20 to 23 of the endoscope 3 can be located, and in which especially a circuit 24 for the control of the video sensor 16 and lamps 25 and 26 are arranged.

Depending upon the design of the cable drum 1 according to the invention the signals supplied by the video sensor 16 can be output directly through a slip ring 31, which is described below in more detail, and over the plug sockets 14 and 15, in order to be analyzed. It is also possible to design the circuit 24 in such a manner that the video signals of it are analyzed, in order to produce finished video signals, which are output over the slip ring 31 and the plug sockets 14 or 15 for the drive of a data terminal.

The lamps 25, 26 supply light of daylight quality, can thus be called daylight lamps and are designed as arc lamps, as xenon lamp or as metal halide lamps, for whose operation high voltage start units 25', 26' (see Fig. 3) are necessary. In the present design example the lamps 25, 26 exhibit lamp reflectors, which have an elliptical form when viewed as a cut along the longitudinal axis of the lamp, in order to bundle the radiated light as far as possible. It is also conceivable to use for this purpose focusing optics, which are located in front of the lamps. The lamps 25, 26 and the video sensor 16 are supplied with current by the power supply 13. The heat development of the lamps 25, 26, which each use up to 300 Watts, makes it in addition necessary to arrange in their proximity the fan 27 for the cooling of the lamps 25, 26, which is likewise supplied with current from the power supply 13. In order to protect the optical cables 28, 29 against overheating through larger luminous intensity, it is possible to arrange infrared filters between the lamps 25, 26 and the front surfaces of the optical cables of 28, 29.

The cable drum 1 serves primarily for winding up the probe 2, which consists of a probe

protection casing 2', in which the optical cables 28 and 29 and electrical wires 30 are led. The optical cables 28, 29 can be manufactured from glass or from plastic. Modern light conductors enable here probe lengths up to 30 meters. The wires 30 supply the video sensor 16 on the one hand with voltage and can on the other hand transmit the electrical signals supplied by the video sensor 16 through the slip ring 31, which is described below in more detail, directly to the plug sockets 14 and 15, in order to be analyzed.

The lamps 25 and 26 are arranged in such a way opposite the surfaces 28' and 29' at the beginning of the optical cables 28 and 29 that the light radiated from the lamps 25 and 26 is coupled completely into the optical cables 28 and 29. Through the optical cables 28 and 29 the light is conducted to the video sensor 16 arranged at the end of the probe 2, at whose face on the one hand the individual light conductors end, so that the light conducted in them can be radiated, and at whose face on the other hand a sensor optics is arranged, over which the surrounding lit up by the light of the light conductor can be recorded. The probe 2 and the video sensor 16 have here a mostly identical diameter, which can, depending on the application, amount to 5 mm, 8 mm, 10 mm or 12.7 mm.

In Fig. 2 a cut through the cable drum 1 along the bent line A-A in Fig. 1 is shown. The stand 4 with the handgrip 7 and the foot 5 and the probe winding 2" can be seen. This perspective permits a view both into the central hollow space 11 and into the ring-shaped hollow space 19 of the cable drum 1. The lamps 25 and 26 arranged in the ring-shaped hollow space 19 including their voltage supply lines 32 and 33 are concretely recognizable with the selected line of sight. The optical cables 28 and 29 are drawn dashed, as with the selected line of sight the ring-shaped hollow space 19 is covered by the central hollow space 11 of the cable drum 1 within the area, within which the optical cables 28, 29 a guided for a bit, before they emerge at an outlet position 34 from the circular hollow space 19.

Also shown in Fig. 2 is the axle 9, which is firmly connected with the stand 4. The axle 9 is designed as a pipe to accommodate electrical wires and exhibits on its side opposite to the stand 4 a holding disk 35 to axially mount the cable drum 1 on the axle 9 and in addition a slip ring 31, which is electrically connected to the wires led inside the axle 9 (see in particular for this Fig. 3) and whose lateral surface is in electrical sliding contact both with the voltage supply lines 32 and 33 of the lamps 25 and 26 and with the electrical wires 30 of the video sensor 16. Finally a cranking grasp 39 is attached at the cable drum 1, in order to be able to rotate the cable drum 1 manually.

Also drawn dashed in Fig. 2 is an additional housing 40, which can be mounted on the stand 4, in which the power supply 13 and the battery 12 can be arranged.

In Fig. 3 without consideration of the internal structure of the cable drum 1 some electrical details concerning the core of the invention are represented. The axle 9 firmly connected mechanically with the stand 4 is shown as a pipe, on which the cover plate 10 is fastened. Attached to it is for example the plug socket 18 for AC voltage, which is connected with the power supply 13 and the plug socket 15 for the video sensor 16.

The lines 36 for the voltage supply of the lamps 25 and 26 and the video sensor 16, attached to the power supply 13, are led within the tubular axle 9 up to the slip ring 31 sitting on top of it and are connected electrically with the slip ring contact 31' for the voltage supply of the video sensor 16 and with the slip ring contacts 31" and 31'" for the voltage supply of the lamps 25 and 26. The sliding contact 30a' connected with the electrical wire 30a for the voltage supply of the video sensor 16 is here in electrical connection with the slip ring contact 31'. The sliding contact 33' connected with the electrical wire 33 for the voltage supply of the lamp 26 is connected with the slip ring contact 31". The sliding contact 32' connected with the electrical wire 32 for the voltage supply of the lamp 25 is electrically connected with the slip ring contact 31'". Finally also the signal line 30b of the video sensor 16 is connected with a sliding contact 30b' and has an electrical connection with the slip ring contact 30"". This one is connected with the plug socket 15 for the video sensor 16 through a video signal line 38 led inside the axle 9, to which a circuit can be attached for the analysis of the video signals. Here the sliding contacts 30a', 30b', 32' and 33' are mechanically fixed but electrically insulated connected with the internal shell-shaped part 37 of the cable drum 1.

Drawn in Fig. 3 is also the holding disk 35, which sits firmly on the axle 9 and prevents an axial shifting of the cable drum 1, which is mounted pivoted on the axle 9.

During operation of the probe 2 the light of the lamps 25 and 26 is coupled into the optical cables 28 and 29, which unite together with the electrical wires 30a and 30b for the video sensor 16 to a probe 2 and emerge afterwards from the interior of the cable drum 1 through the outlet position 34. In Fig. 3, during the rotating motion of the cable drum 1 accompanied by the winding up and off of the probe 2 the stand 4, the axle 9, the cover plate 10, the slip ring 31, and the holding disk 35 remain stationary in their base position. Set into motion together with the cable drum 1 are only the lamps 25, 26, the optical cables 28, 29 and the electrical wires 30a, 30b, 32 and 33 including the sliding contacts 30a', 30b', 32' and 33'.

All features represented in the description, the following claims and the drawings can be substantial for the invention both individually and in arbitrary combination with one another.

Reference number list

1	Cable drum
2	Probe
2'	Probe protection casing
2"	Probe winding
3	Video endoscope
4	Stand
5, 6	Feet of the stand 5
7	Hand grip
8	Center of the stand 5
9	Axle
10	Cover plate
11	Central hollow space of the cable drum 1
12	Battery
13	Power supply
14, 15	Plug sockets for the video sensor
16	Video sensor
17	Plug socket for DC voltage
18	Plug socket for AC voltage
19	Ring-shaped hollow space of the cable drum 1
20 to 23	Further accessories
24	Circuit for controlling the video sensor 16
25, 26	Lamp, daylight lamp
25', 26'	High voltage start units of the lamps 25, 26
27	Fan
28, 29	Optical cable
28', 29'	Surfaces at the beginning of the optical cables
30	Electrical wires for the video sensor 16
30a	Voltage supply line of the video sensor 16
30b	Signal line of the video sensor 16
30a', 30b'	Sliding contacts
31	Slip ring
31', 31"	Slip ring contacts
31"', 31""	Slip ring contacts
32, 33	Voltage supply lines of the lamps 25, 26
32', 33'	Sliding contacts
34	Outlet position
35	Holding disk
36	Lines outgoing from the power supply 13
37	Internal shell-shaped part of the cable drum 1
38	Video signal line
39	Cranking grasp
40	Additional housing

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Summary

A cable drum (1) for a video endoscope (3) which is designed as probe (2) with at least one optical cable (28) is suggested, whose beginning is inserted into the cable drum (1), whereby light can be coupled into the front surface (28') of at least one optical cable (28) of each daylight lamp (25) arranged in the cable drum (1)

Fig. 1

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Claims

1. Cable drum for a video endoscope,
   - with a stand (4) on which the cable drum (1) is pivoted arranged,
   - with an endoscope (3), designed as probe (2), which exhibits a video sensor (16) with connected lines (30) for the voltage supply of the video sensor (16) and for the transfer of the signals supplied from the video camera,
   - whose lines (30) are wound up on the cable drum (1) and are electrically interconnected with a slip ring (31) attached to the stand (4),
   - characterized by the fact that the probe (2) exhibits at least one optical cable (25, 29), whose beginning is inserted into the cable drum (1),
   - that the front surfaces of the optical light guides at the beginning of at least one optical cable (28, 29) are arranged in such a manner opposite each one daylight lamp (25, 26) connected with the cable drum (1) that light can be coupled to the front surfaces,
   - that the front surfaces of the optical light guides are arranged at the end of at least one optical cable (28, 29) close to the video sensor (16) for the lighting of the

surrounding to be filmed by the video sensor (16) with the light emerging from the ends of the optical light guides and
- that the daylight lamps (25, 26) are supplied with electric current through the slip ring (31).

2. Cable drum according to claim 1, characterized by the fact that a circular cover plate (10) is firmly connected with the stand (4), which covers a central and open towards the front hollow space (11) of the cable drum (1).

3. Cable drum according to claim 2, characterized by the fact that plug sockets (14, 15) which are electrically interconnected with the slip ring (31) at the cover plate (10) are arranged for the output of the signals supplied by the video sensor (16).

4. Cable drum according to claim 2 or 3, characterized by the fact that in the hollow space (11) a re-chargeable battery (12) is arranged, which is mechanically attached to the stand (4) and electrically connected to the slip ring (31), and that at the cover plate (10) a plug socket (17) for DC voltage, electrically connected with the battery (12), is attached.

5. Cable drum according to claim 2 to 4, characterized by the fact that in the hollow space (11) a power supply (13) connected mechanically with the stand (4) is arranged, which is electrically attached to the slip ring (31), and that at the cover plate (10) a plug socket for AC voltage (18), connected with the power supply (13), is arranged.

6. Cable drum according to claim 2 to 5, characterized by the fact that the centrally located hollow space (11) of the cable drum (1) is surrounded by a ring-shaped hollow space (19), in which the lamps (25, 26) are arranged and into which the beginning of at least one optical cable (28, 29) is inserted.

7. Cable drum according to claim 6, characterized by the fact that in the ring-shaped hollow space (19) a circuit (24) is arranged for the control of the video camera (16).

8. Cable drum according to claim 6 or 7, characterized by the fact that at the wall of the ring-shaped hollow space (19) near the lamps (25, 26) a fan (27) for cooling the lamps (25, 26) supplied with current by the power supply (13) is arranged.

9. Cable drum according to one of the preceding claims, characterized by the fact that the lamps (25, 26) are designed as arc lamps.

10. Cable drum according to claim 1 to 8, characterized by the fact that the lamps (25, 26) are designed as xenon lamps.

11. Cable drum according to claim 1 to 8, characterized by the fact that the lamps (25, 26) are designed as metal halide lamps.